Capital Markets Review Vol. 31, No. 2, pp. 89-101 (2023)

The Performance of ESG ETFs in the U.S.

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Abstract: Research Question: ESG ETFs may serve noble purposes of investors. However, do they help them gain material financial returns? This paper seeks to answer this question by examining the performance and performance persistence of the ESG equity ETFs in the U.S. **Motivation:** This study has been motivated by the strong interest in ESG investments, and particularly in ESG ETFs. This interest is evidenced by the billions of dollars which are invested in relevant financial products worldwide. **Idea:** A common belief among many investors is that ESG investing requires a level of sacrifice in terms of financial returns. In this study, we examine the idea of the "waived" financial returns is the case for ESG ETFs. **Data:** The sample includes 61 ESG equity ETFs traded in the United Sates. The study period spans from 1/1/2019 to 31/12/2021. **Method/Tools:** Performance and performance persistence is examined with standard methodology, which includes the single-factor market model, the Fama-French-Carhart six-factor model and risk-adjusted metrics, such as the Sharpe and Treynor ratios. **Findings:** The findings show that, in raw return terms, the average ESG ETF outperforms the S&P 500 Index, even though there are several funds in the sample which do not do so. Moreover, about 16% of the examined ESG ETFs (10 out of 61 ETFs) offer positive and significant alphas. The average term of these significantly positive alphas is 7 bps and are obtained via the multi-factor performance regression model but not via the single-factor model. With respect to persistence, daily returns display a reverting behavior. This pattern applies to weekly returns too, but with less statistical significance. **Contributions:** Sustainable investing with mutual funds has drown significant interest by researchers. However, ESG ETFs are under-researched. We aim at fulfilling this gap in the literature. In addition, the results obtained are quite encouraging to investors. In some cases, ESG ETFs in the U.S. are found to outperform the market index in some cases. This finding implies that, from a financial perspective, ESG investing is not an a priori lost cause, as it is frequently considered to be.

Keywords: ETFs, ESG, performance, performance persistence.
JEL Classification: G11

1. Introduction

The environmental, social and governance aspects (ESG) of investments have attracted major interest within the investing community worldwide over the last two decades, as well as with the financial literature. For instance, Hamilton *et al.* (1993) find that there are not significant

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Received 24 Jan 2023; Final revised 10 May 2023; Accepted 15 Sep 2023; Available online 30 Sep 2023.
To link to this article: https://www.mfa.com.my/cmr/v31_i2_a5/

differences in returns between socially responsible funds and traditional funds. DiBartolomeo and Kurtz (1996) report that the Domini Social Index slightly outperformed the S&P 500 Index over the period May 1990 to September 1993. However, the authors conclude that this outperformance is not significant. Statman (2000) finds some evidence that SR funds in the U.S. outperform their conventional peers. However, this performance advantage of SR funds is not significant in statistical terms. In Europe, Kreander *et al*. (2005) examine the performance of 60 ethical funds from the UK, Sweden, Germany and the Netherlands over 1995-2001 and find that there is no difference between ethical and non-ethical funds. Halbritter and Dorfleitner (2015) show that there is no significant difference in performance between firms with high and low ESG ratings. Dolvin *et al*. (2019) find that the risk-adjusted return of funds with high sustainability scores approximate the corresponding returns of funds without such high scores. In the same context, Chang *et al*. (2020) show that the correlation between sustainability and fund returns is very low.

The increased interest in ESG investing has become an international reality and is expected to get bigger in the years to come. According to Bloomberg Intelligence (BI), ESG assets are going to exceed $53 trillion by 2025, or more than a third of the projected total assets under management during that period. BI also highlights that Europe holds half of the global ESG assets but the U.S. is now increasing its share in the international ESG investment business. The next boost is expected to come from Japan.[1]

The Exchange Traded Funds (ETFs) market has responded to this interest by launching tens of funds to serve several causes and purposes. As a result, in the United States there are ESG ETFs that invest in stocks of the local, developed and emerging markets, bond and green bond ESG ETFs, fossil-free ETFs, low-carbon and climate transition ETFs, clean energy, smart grid and cleantech ETFs, as well as several other classes of ESG ETFs.[2]

The objectives of investors applying ESG criteria in their investing decisions are classified in three main categories. The first one is values-based investing, which tries to align ethical, religious, environmental, social or other values of investors with industries and companies that apply the same values. In values-based investing, financial returns are not top priority for investors. The second category concerns impact investing, which seeks opportunities to create a positive social or environmental impact, frequently at expense to financial performance. The third category includes ESG integration, which tries to build a sustainable portfolio with the view of boosting risk-adjusted returns in the long-run by identifying financial risks and opportunities relating to ESG issues.

The performance of ESG equity ETFs in the U.S. is examined in this study over the period 1/1/2019 - 31/12/2021 with standard methodology found in the literature. In the first step, raw returns are computed. Then, the single-factor market model is used to assess whether ESG ETFs produce any significant alpha over the S&P 500 Index. Multifactor regression analysis of ETFs' performance is conducted too. Next, risk-adjusted return metrics are computed, including the Sharpe, Treynor, Sortino and Information ratios. Finally, the persistence in raw returns of ESG ETFs is assessed.

The empirical findings reveal that the ESG ETFs in the sample achieved positive average raw returns and significant cumulative returns during the period under study. Moreover, several ETFs in the sample present superior cumulative raw returns in comparison to the S&P 500 Index but they are slightly riskier than the market index. Going further, the multi-factor performance regression model produces positive and statistically significant alphas over the S&P 500 Index for one sixth of the examined funds. This model also indicates that the Fama and French (2015) factors can explain the performance of ESG ETFs, to a lower or a higher

[1] Refer to https://etfdb.com/multi-asset-channel/capture-the-global-esg-expansion-with-this-etf/.
[2] Refer to https://sustainfi.com/esg-fund-list/ for a complete list of U.S. ESG ETFs categories and funds in each category.

degree. Furthermore, with the exception of Information ratio, the risk-adjusted returns of ESG ETFs are found to be positive over the study period. Finally, on the question of persistence, the results show that the daily raw returns of ESG ETFs are negatively related to their one-lagged returns. This is also the case for weekly returns, even though the statistical significance of the relevant regression slopes is lower than that of daily returns. On the contrary, there is no significant relationship among monthly returns.

This study has been motivated by the strong general interest in ESG investments, and particularly in ESG ETFs. It contributes to the ESG literature in several ways. To the best of our knowledge, even though sustainable investing with mutual funds has drown significant interest by researchers, ESG ETFs are under-researched. Thus, we aim at fulfilling this relative gap in literature. Moreover, this study uses a comprehensive set of ESG ETFs traded on the U.S. stock market, given the limited number of such products relative to more traditional ETF types. Furthermore, the research methodology applied, even being standard in the literature, gives us the opportunity to assess performance from several angles. Finally, the results obtained are quite encouraging to investors, and not only those who are concerned about the ESG aspects of their choices. In particular, ESG ETFs in the US are found to outperform the market index in some cases. This finding implies that, from a financial perspective, ESG investing is not an a priori lost cause, as it is frequently considered to be. Finally, we believe that the reverting behavior observed in daily and weekly raw returns could be exploitable, especially by short-run traders. To our view, this is a significant contribution to the relevant literature.

The remainder of this paper is structured as follows: Section 2 provides the literature review. Section 3 develops the research methodology applied in our study and describes the sample used. Empirical findings are discussed in Section 4 and conclusions are offered in Section 5.

2. Literature Review

The literature on ESG ETFs is not that voluminous. Most of the relevant studies deal with the performance of ESG ETFs. In this respect, Marozva (2014) compares the return of ETFs listed in the Johannesburg Stock Exchange to the return of the JSE SRI Index during 2004-2014. The author finds that there are no significant return differences between ETFs and the index during periods of economic growth. However, the JSE SRI Index significantly underperformed ETFs during periods of recession.

In the same context, Meziani (2014) applies a series of typical performance metrics to all of the current ESG ETFs to measure whether they offer potential to satisfy a classical risk-return assessment of their performance. The results documented are mixed. Although the annual growth and risk-adjusted returns of ESG ETFs relative to the market are notable, the same cannot be said about their performance in terms of the risk taken to achieve these returns and with respect to the important systematic risk they contribute. Meziani (2020) re-investigates ESG ETFs and indicates that, despite the weak start of these funds, they are now beginning to show some improvement in their performance as their risk-adjusted return is now better than it used to be during their first years in the business. They are also doing better in terms of alpha.

The performance of water ETFs is the subject of the study by Rompotis (2016). The performance of ETFs is examined against the performance of the tracking indexes, the S&P 500 Index and the market portfolio built by Fama and French. The findings show that, regardless of the benchmark used, water ETFs cannot offer investors significant above-market returns. On the contrary, in several cases, negative and significant alphas are estimated. These negative alphas are comparable to the fees charged by the funds.

The return and risk of ESG ETFs is also assessed by Kanuri (2020) over a period spanning from February 2005 to July 2019. The author compares ESG ETFs to investable proxies for U.S. and global equity markets. The results show that even though ESG ETFs outperformed the market indexes in some periods, indexes outperformed ESG ETFs during the entire study period.

Going further, Plagge and Grim (2020) assess the performance of investable ESG equity index funds, active mutual funds and ETFs with a U.S. investment focus over a period of fifteen years (2004-2018). The majority of funds in any of the examined ESG categories does not produce statistically significant positive or negative alphas. Overall, return and risk differences of ESG mutual funds and ETFs can be significant but they are mainly driven by fund-specific criteria rather than by a homogeneous ESG factor.

Milonas *et al*. (2022) study the returns of 80 European and 64 U.S. funds and attempt to identify whether those funds that invest in companies ESG principles differ from conventional funds in terms of performance. The alpha, Sharpe ratio, Treynor ratio, and excess daily returns are used as various measures of performance. The five-factor Fama-French model is also applied to distinguish possible different influences of explanatory variables on ESG and non-ESG funds. The empirical findings do not reveal any statistically significant difference between ESG and non-ESG funds although the former have slightly higher returns than the latter.

Finally, Rompotis (2022a) examines the performance of 49 ESG ETFs in the UK. Raw and risk-adjusted returns are estimated with standard methodology including the single-factor market model, the Fama and French (2015) six-factor model, and the Sharpe and Treynor ratios. On average, no significant alpha is achieved by ESG ETFs in the UK. In addition, there are not differences in Sharpe and Treynor ratios between ETFs and their benchmarks. However, some empirical evidence obtained indicates that ESG ETFs outperform the FTSE 100 Index, which stands as a proxy for the UK stock market.

In another context, Rodríguez and Romero (2019) assess the diversification value of socially responsible (SRI) ETFs with a global exposure, in comparison to more traditional peers. By estimating orthogonal returns, that is, returns of a market free from the influence from other markets, and applying a two-factor model to infer the exposure to international markets of SRI ETFs, they find that the international diversification value of SRI ETFs is significantly higher than that of the corresponding conventional ETFs.

Rompotis (2022b) examines whether a high ESG rating induces investors to allocate more money in an ETF. The findings indicate that the level of assets is not affected by the ESG rating whatsoever, but it is affected by factors such as the historical performance, the expense ratio and the age of each fund. Furthermore, the relationship between the performance of an ETF and its ESG rating is assessed by assuming an ETF with a high ESG rating should present high returns too. The results do not confirm this hypothesis.

In a quite different subject, Rompotis (2023b) investigates whether the U.S.-traded ESG ETFs are involved in "greenwashing" tactics. Greenwashing implies that a "green" company or a fund needs to make consumers and investors believe that they are doing more to protect the environment than they actually do. Twenty-four ESG ETFs are examined with data from the inception of each fund up to June 30, 2022. The correlations of ETFs with the S&P 500 Index are calculated, as well as corresponding betas. Then, the portion of the S&P 500 companies with severe or high Morningstar ESG risk scores included in each ESG ETF's holdings is calculated. The findings reveal a high correlation of ESG ETFs with the S&P 500 Index for the majority of ETFs in the sample. In addition, 25% of the examined ETFs invest a significant portion of their assets in S&P 500 companies with high or severe ESG risk. The latter finding could be indicative of greenwashing behavior on behalf of ESG ETFs.

3. Methodology

In this section, we develop the methodology used in our empirical analysis of ESG ETFs' performance. First, we compute the raw returns of ETFs. A single-factor and a multi-factor regression analysis of ETFs' performance follows. Then, the risk-adjusted return of ETFs is calculated. Finally, the persistence in raw returns is evaluated. The methodology employed in our analysis is standard in the studies of financial literature dealing with the performance and performance persistence of mutual funds, ETFs and other similar products. For instance, the multi-factor analysis of performance is found Fama and French (2015). Milonas *et al*. (2022) have used a five-factor model to assess the performance of comparative ESG and non-ESG European funds. They also use Sharpe and Treynor ratios to evaluate the risk-adjusted return of the European funds. Goldreyer *et al*. (1999) also measure the performance of a U.S. sample of SR and conventional mutual funds using the Jensen's alpha, the Sharpe Ratio and the Treynor ratio. Rompotis (2023a) uses a one-lagged model to evaluate performance persistence.

3.1 Raw Returns

We compute the raw return of ESG ETFs in percentage terms over the period 2019-2021 with daily data found on www.nasdaq.com. Return is calculated with formula (1):

$$R_{i,t}= \frac{P_{i,t}-P_{i,t-1}}{P_{i,t-1}} \quad (1)$$

where $R_{i,t}$ refers to the percentage daily return of the *ith* ETF on the trade day *t* and $P_{i,t}$ refers to the close trade price of the ETF on day *t*.[3] Formula (1) is also used for the calculation of market performance. We use the S&P 500 Index as a proxy for the market. In addition, formula (1) is used for the calculation of total (or cumulative) return of ETFs and market over the entire period under study. Finally, the risk of ETFs and the market index is calculated as the standard deviation in daily returns.

3.2 Single-Factor Performance Analysis

The first model used to examine the performance of ESG ETFs is the following:

$$R_i\text{-}R_f=\alpha_i+\beta_i(R_m\text{-}R_f)+\varepsilon_i \quad (2)$$

where R_i denotes the daily return of ESG ETFs, R_m represents the return of the S&P 500 Index and R_f is the risk-free rate expressed by the one-month US Treasury bill rate.

Alpha represents the above-market return that can be achieved by an ETF. If ETFs can achieve above-market returns, alpha estimates will be positive and statistically significant. Beta measures the part of risk that cannot be mitigated by diversification techniques and indicates the systematic risk of ESG ETFs.

3.3 Multifactor Performance Analysis

We evaluate the exposure of ESG ETFs to certain market factors with the Fama and French (2015) five-factor model, in which we add the momentum factor of Carhart (1997). The model is shown in equation (3):

$$R_i\text{-}R_f=\alpha_i+\beta_{1,i}(R_m\text{-}R_f)+\beta_{2,i}SMB+\beta_{3,i}HML+\beta_{4,i}RMW+\beta_{5,i}CMA+\beta_{6,i}MOM+\varepsilon_i \quad (3)$$

[3] We have also calculated the absolute returns with dividend-adjusted price data. These returns do not differ from the dividend-free returns. For simplicity purposes, we only report the latter returns.

where R_i, R_m and R_f are defined as above. SMB (Small Minus Big) is the average return on nine small cap portfolios minus the average return on nine big cap portfolios. HML (High Minus Low) is the average return on two value portfolios (in book-to-market equity terms) minus the average return on two growth portfolios. RMW (Robust Minus Weak) is the average return on two robust operating profitability portfolios minus the average return on two weak operating profitability portfolios. CMA (Conservative Minus Aggressive) is the average return on two conservative portfolios minus the average return on two aggressive portfolios. MOM is the average of the returns on two (big and small) high prior return portfolios minus the average of the returns on two low prior return portfolios.[4]

In the Fama and French model, the size effect implies that small cap companies outperform large firms. The book-to-market equity ratio effect captured by the HML factor implies that the average returns on stocks with a high book-value to market-value equity ratio must be greater than the returns on stocks with a low book-value to market-value equity ratio.

The Conservative Minus Aggressive and Robust Minus Weak factors correspond to the Fama and French (2015) investment and operating profitability factors. Past investment is viewed as a proxy for the expected future investment and suggest that CMA implies a negative relationship between the expected investment and the expected internal rate of return. Based on the findings of Fama and French (2015), a negative loading is expected for the RMW factor, that is, the excess return of ESG ETFs must be affected by the profitability factor in a negative fashion.

Finally, the existence of a momentum in asset prices is considered a, difficult to explain, anomaly because, according to the efficient capital markets theory, an increase in the price of an asset cannot indicate a further increase in future prices. An explanation to this anomaly offered by behavioralists is that investors are not rational and that they underreact to the release of new information, thus, failing to reflect new information into stock prices.

3.4 Risk-Adjusted Returns

We employ standard risk-adjusted return measures to rate the performance of ESG ETFs. The first evaluation method used is the Sharpe ratio shown in formula (4):

$$S_i = \frac{R_i - R_f}{\sigma_i} \tag{4}$$

where R_i and R_f are defined as above and σ_i is the standard deviation of ETF excess return, that is ETF return minus the risk-free rate. The Sharpe ratio is used to determine how well an ETF compensates its investors for the per unit risk they take. The higher he Sharpe ratio, the better the performance of the ETF.

The second risk-adjusted return estimated concerns the Treynor ratio shown in formula (5):

$$T_i = \frac{R_i - R_f}{\beta_i} \tag{5}$$

where R_i and R_f are defined as above and β_i is the systematic risk of ESG ETFs. Two versions of the Treynor ratio are considered. The first one includes the betas deriving from the

[4] The historical daily data of risk-free rate, Fama and French three factors, robust minus weak factor and conservative minus aggressive factor and momentum factor are available on the website of Kenneth French on http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

performance regression model (2). The second uses the betas obtained from the six-factor model (3). Similar to the Sharpe ratio, the higher the Treynor ratio, the better the performance of ETFs.

The third method used is the Sortino ratio depicted in formula (6):

$$Sor_i = \frac{R_i - R_f}{\sigma_{i,d}} \tag{6}$$

where R_i and R_f are defined as above and $\sigma_{i,d}$ is the standard deviation of ESG ETFs' negative excess returns. The Sortino ratio differentiates between good and bad volatility in the Sharpe ratio. This differentiation of upward and downward volatility allows risk-adjusted returns to provide a performance measure of ETFs without penalizing them for upward price changes. Similar to the Sharpe and Treynor ratios, the higher the Sortino ratio, the better the performance of ESG ETFs.

The last risk-adjusted return metric used in the Information ratio (IR) shown in formula (7):

$$IR_i = \frac{R_i - R_m}{TE_i} \tag{7}$$

where R_i is defined as above, R_m is the return of the S&P 500 Index, and TE_i is tracking error, that is, the standard deviation in return differences between the ESG ETFs and the market index. The IR is used as a measure of an ESG ETF's excess return against the market return. Thus, positive IRs will indicate that the respective ESG ETFs outperform the market.

3.5 Performance Persistence

The persistence in raw returns of ESG ETFs is assessed via the following regression model (8):

$$R_i = \lambda_0 + \lambda_1 R_{t-1,i} + u \tag{8}$$

where R_i is defined as above. Persistence in returns will be assessed by the slope of the model. Statistically significant slopes approximating unity will indicate a high degree of performance persistence.

3.6 The Sample

The sample includes 61 equity ESG ETFs traded on the U.S. market. The number of ESG ETFs in the US nowadays is bigger than the number of funds included in our sample (86 ESG ETFs according to https://sustainfi.com/esg-fund-list/). However, we focus solely on equity ESG ETFs and, thus, we exclude bond and other non-equity ETFs. In addition, many launches of ESG ETFs took place in the U.S. over the last two years. In our analysis, we needed sufficient return data to apply substantive testing on performance. Thus, we decided that a period spanning from 1/1/2019 to 31/12/2021 is decent enough for the purposes of our analysis. No other selection criterion has been applied. As a result, our sample is limited to these 61 ESG ETFs.

Table 1 presents the profiles of ESG ETFs, which include their ticker, name, inception date, age as of 31/12/2021 (in years), expense ratio, average daily volume over the period 1/1/2019-31/12/2021, average trading frequency, as the fraction of the days with no zero volume to the entire to total trade days over the period 1/1/2019-31/12/2021, average intraday

volatility, computed as (Daily Highest Price-Daily Lowest Price)/Daily Close Price, and assets under management as of 31/12/2021.[5]

The average age of ESG ETFs approximates eight years while the oldest ETF in the sample is about 17 years old. Overall, age indicates that this section of the ETF market is relatively young. This fact might have implications for the management and performance of these funds.

The average expense ratio of ESG ETFs is equal to 43 basis points (bps). The minimum expense ratio is 9 bps, which is comparable to the expense ratios of several popular traditional ETFs. The maximum expense record in the sample is 79 bps, which is comparable to the expense ratios of actively managed ETFs.

When it comes to trading activity, the average daily volume in Table 1 amounts to 156th. shares. It is notable that the range between the minimum and maximum volumes in the sample is huge. If we focus on the median term of volumes, we can see that the daily trading activity for most of ESG ETFs in the sample does not exceed 26 th. shares per day. This is not a might trading activity relative to the popular traditional ETF products.

The average trading frequency is high at 99.6%. This indicates that, on average, ESG ETFs present only a few days of zero trading activity. The minimum trading frequency in the sample just exceeds 88%. Therefore, there are ESG ETFs whose trading activity is lower than the average term in the sample. Lower trading activity might imply liquidity issues for the corresponding ESG ETFs.

With respect to intraday volatility, the respective average term in Table 1 is 1.25. The median term is lower at 1.13. These low measures indicate that the period under study has been a rather smooth era for the ESG ETF market.

Finally, in regard to assets, Table 1 shows that the average ESG ETF in the sample managed about $1.6 billion at the end of 2021. The largest equity ESG ETF is the iShares ESG Aware MSCI USA ETF (ESGU), with assets exceeding $25 billion. On the other hand, the bottom record of assets in the sample is just $28 million. Overall, the rather small figure of assets, compared to the hundreds of billions managed by several successful traditional ETFs, may be the result of the fact that ESG investing became a trend in the U.S. only recently.

4. Empirical Results

4.1 Raw Returns

The descriptive statistics of returns are provided in Table 2. The table presents the average daily return, the median daily return, the standard deviation of returns, and the minimum and maximum returns of ESG ETFs. The cumulative return of each ETF over the period 2019-2021 is also presented along with the average daily and the cumulative excess return of each ETF against the S&P 500 Index, as well as the excess risk relative to the market index.

The average daily return of ESG ETFs is 10 bps, while all of them present positive average daily returns. Moreover, the average cumulative return in the sample over the study period is very high at 99%, whereas all ESG ETFs achieved positive cumulative returns. These returns seem to be quite satisfactory. In comparison to the S&P 500 Index, the average daily excess of ESG ETFs is not different from zero. However, at the cumulative level, the results indicate that the average equity ESG ETFs outperformed the market index by 910 bps over the period 2019-2021.

This interesting finding shows that investors can have ESG ETF choices that can actually beat the market, at least at the raw return level. However, we should point out that, based on the slightly negative median cumulative excess return, there are ESG ETFs that fall short

[5] Tickers, names, inception dates, expense ratios and assets under management have been found on www.etfdb.com. Volumes have been found on www.nasdaq.com.

when compared to the market index. Consequently, the inference about the outperformance of ESG ETFs against the S&P 500 Index does not apply to all ETFs in the sample. In fact, there are 30 ETFs in the sample which achieved negative excess returns over the S&P 500 Index during the study period.

The average risk estimate of ESG ETFs is 1.62, which is not that high. Moreover, Table 2 reports an average excess risk relative to market risk of 20 bps. In addition, 36 ETFs present risk that is higher than that of the market and 21 ETFs present the opposite. The risk of the rest 4 ETFs is equal to that of the market index. Overall, the measures of excess risk, combined with the positive excess cumulative returns, indicate that the outperformance of ESG ETFs comes with a cost in terms of the increased risk taken.

The main conclusion that can be reached by analyzing raw returns and risks is that, on average, ESG ETFs can beat the market, even though there are many funds in the sample that cannot do so. On the other hand, it seems that the total risk of these ETFs is slightly higher than the market risk. This increased risk assumed by investors can be justified in the cases that ESG ETFs outperform the market index.

4.2 Single-Factor Performance Analysis

The results of the single-factor performance regression analysis are reported in Table 3. The table includes the alpha and beta estimates along with t-tests on the statistical significance of estimates and R-squared on the explanatory power of the model.

The average alpha estimate of ESG ETFs is slightly positive amounting to 1 bps. However, the majority of individual alphas are statistically insignificant, while there are just two significantly positive alphas and one significant alpha which is negative. On the one hand, these results show that ESG ETFs in the U.S. cannot produce any material alpha relative to market performance. On the other hand, the insignificant alphas also indicate that the performance of ETFs is quite aligned to the performance of the S&P 500 Index.

In regard to the systematic risk of ESG ETFs, Table 3 reports an average beta which is lower but approximates unity. Furthermore, about 67% of beta coefficients are lower than unity. These results may indicate a conservatism of ESG ETFs relative to the market index. However, these results might be viewed as if the ESG ETFs in the sample invest in stocks and markets which are not absolutely comparable to the S&P 500 Index.

4.3 Multifactor Performance Analysis

The results of the six-factor performance regression model (3) are provided in Table 4. The table includes the alpha coefficients along with the estimates of the explanatory variables of the model. T-tests on the statistical significance of estimates are offered too along with R-squared on the sufficiency of the model to explain the performance of ESG ETFs in the sample.

The results concerning the above-market return of ESG ETFs are slightly different to those obtained via the single-factor model. The average alpha is slightly positive at 2 bps, with the majority of individual alpha estimates being insignificant. However, there are ten cases in which ESG ETFs offer positive and significant alphas. The average term of these significantly positive alphas is 7 bps. Based on these results, we may infer that the performance of ESG ETFs is, at least, in line with market performance but ESG ETFs beating the market can be found too.

The estimates of systematic risk are essentially equal to those obtained from the single-factor performance regression model. The average beta is equal to 0.93 (it was 0.95 in the single-factor market model above). In addition, the average difference in betas between the single- and the multi-factor models is 0.02 (not reported in Table 4).

The results on size factor reveal a positive relationship between the performance of ESG ETFs with this factor. There is only one SMB estimate which is significantly negative, while, with just five exceptions, all other estimates are positive and significant at 10% or better. This positive correlation between ESG ETFs' return and size factor may be the result of ESG ETFs being small-cap portfolios themselves. As the size factor of Fama & French implies that small-cap entities perform better than the larger ones, our results seem to verify this assumption.

In regard to the relationship between ESG ETFs' performance and the value factor, 21 and 17 significantly positive and negative HML estimates, respectively are found in Table 4. This variation in significant estimates shows that there is not a consistent relationship between performance and the value factor. This relationship seems to be fund specific.

On the impact on ETF performance by the Robust Minus Weak factor, the results reveal a negative effect for 38 ETFs in the sample and a positive relationship in 5 cases. The rest RMW estimates are insignificant. The negative sign for the majority of the significant estimates in the sample is in line with our expectations about a negative relationship between the performance of ESG ETFs and the RMW factor.

When it comes to the Conservative Minus Aggressive (CMA) factor, the results indicate a negative effect for 31 ETFs in the sample and a positive relationship in 7 cases. Overall, the results partially verify our assumption about a negative relationship between performance and the CMA factor, as suggested by Fama and French (2015).

Finally, when it comes to the impact on the performance of ESG ETFs by the market momentum factor, the empirical findings show that this relationship is not that strong. More specifically, 13 MOM estimates are positive and significant and 4 are significantly negative. The rest of the estimates are not statistically significant at any acceptable level. Based on these findings, we cannot make a solid inference about the impact of market momentum on returns achieved by ESG ETFs over the period 2019-2021. At best, the relationship between performance and the momentum factor is fund specific.

4.4 Risk-Adjusted Returns

The estimates of risk-adjusted returns are provided in Table 5. The table reports the five alternative types of risk-adjusted returns computed, that is the Sharpe ratio, Treynor ratio I and II, based on the betas from the single-factor and the six-factor performance regression models, respectively, Sortino ratio and Information ratio.

All the induvial estimates of Sharpe, Treynor and Sortino ratios are positive. The average Sharpe ratio is 6 bps. The average Treynor ratios I and II are both equal to 10 bps. The average Sortino ratio is 7 bps. Moreover, no significant variation is observed among the sample's single Sharpe, Treynor and Sortino ratios. Overall, these results indicate that the return achieved by ESG ETFs, at least, compensate investors for the risk they take by investing in them.

The estimates of Information ratio deviate from the previous four types of risk-adjusted return. The average term of the sample is slightly negative at -1 bps. In addition, 37 single information ratios are negative, three are equal to zero and 21 are positive. The negative ratios indicate that the corresponding ETFs underperform the S&P 500 Index. The opposite is the case for the positive information ratios.

Overall, the analysis of risk-adjusted returns reveals that, at least, the ESG ETFs can produce positive adjusted to risk returns, while there is a significant number of cases where these funds can beat the market. These findings are essentially in line with the analysis of raw returns and alphas in the previous sections.

4.5 Performance Persistence

The outcomes of the time-series regression model (8) on the persistence in raw returns of ESG ETFs are provided in Table 6. The table includes the estimates of the model's constant and slope along with t-tests on their statistical significance. R-squared on the explanatory power of the model are reported too.

Panel A in Table 6 reports the results on daily returns. All constants are positive and most of them are statistically significant at 10% or better. These figures show that the returns of ESG ETFs are, obviously, not fully explained by their lagged returns. With respect to the slopes of the model, the average estimate is negative at -0.17. This number implies that after a positive return on day *t*, a negative return follows on day *t+1*, and vice versa. Moreover, all the individual slopes in the sample are negative, while only 10 out of 61 estimates are statistically insignificant. Overall, the regression results on daily returns accentuate that lagged returns can bear an impact on concurrent returns. This impact is negative and could possibly be exploited by short-term traders.

In addition to the persistence in daily returns, we wanted to examine whether the negative relationship among daily returns just established applies to longer investment windows, that is, over weekly and monthly return periods. In doing so, we run model (8) again with weekly and monthly returns. The results of these regressions are provided in Panels B and C in Table 6.

In the case of weekly returns, all the constant coefficients are positive, with 38 of them being significant at 10% or better. Furthermore, with just seven exceptions, the rest single slopes are negative. However, only nine of these negative slopes are significant in statistical terms. In comparison to the results on daily returns, we may conclude that a negative correlation also exists among concurrent and lagged weekly returns. However, this correlation is less significant in statistical terms. Despite the weaker statistical significance of the results, the negative relationship among weekly returns could also be exploitable by investors with very short-term investment horizons.

When it comes to monthly returns, the results deviate significantly from those on daily and weekly returns. In particular, less than half of constants (i.e. 27 out of 61) are significantly positive, with the rest being positive but insignificant. Going further, the slopes are either negative or positive but only one of them is statistically significant. Based on these results, we cannot establish a relationship (of any sign) among the monthly returns of ESG ETFs.

5. Conclusion

This study is an expansion to our previous work on ESG ETFs. It offers new empirical insights on the performance of ESG ETFs traded in the U.S. Standard research issues are examined for a sample of 61 equity ESG ETFs over the three-year period 2019-2021. The issues investigated concern the performance of these funds and their ability to beat the market. The performance persistence is evaluated too.

The results obtained are very interesting. The various return measures employed indicate that the performance of ESG ETFs in the U.S. is comparable to that of the S&P 500 Index. In addition, there is a sufficient number of cases in which ESG ETFs can beat the market index. The latter is verified by the several performance measures assessed, such as raw returns, alphas and risk-adjusted returns. On the other hand, ESG ETFs are found to be slightly riskier than the market in total risk terms. Our results are comparable to the results of Meziani (2020) and Kanuri (2020) in the case of ESF ETFs.

The main inference drawn from the analysis of performance is that ESG investing is not a lost cause in financial terms, as it is frequently believed to be. Therefore, our results defy the common belief in the industry that in order for an investor to be responsible from an ESG perspective, they need to suffer financial sacrifices. However, based on our results about the

risk of ESG ETFs and its comparison to market risk, we should keep in mind that outperformance, if any, is not for free. On the contrary, there is a cost to be paid in terms of the increased risk that must be taken by those investing in ESG ETFs relative to market risk.

Finally, as far as performance persistence is concerned, the results accentuate a negative relationship among the concurrent and one-lagged returns of ESG ETFs. This pattern applies to daily and weekly returns, but not to monthly returns. Profitable investment strategies could possibly be built on the basis of this negative correlation among the daily and weekly returns of ESG ETFs, especially by traders with very short investment horizons.

Apart from the performance of ESG ETFs traded in the European or Asian markets, future research could examine the possible greenwashing tactics of ESG ETFs with data from the European market, which is the leader as far as ESG investing is concerned. Studies that would address the opportunities and challenges of physical climate risks in terms of both mitigation and adaptation in the ETF or mutual fund market should be welcome too.

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